IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant:	Rijks, *et al.*	Docket No.:	EPC-016
Serial No.:	10/537,591	Art Unit:	2836
Filed:	June 6, 2005	Examiner:	Lucy M. Thomas
For:	Driving of an Array of Micro-Electro-Mechanical-System (MEMS) Elements		

Commissioner for Patents
P.O. Box 1450
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REPLY BRIEF

Dear Sirs:

This reply is respectfully submitted in response to the Examiner's Answer mailed May 19, 2009. This brief only addresses points raised in the Response to Arguments section (pages 13-24) of the Examiner's Answer. For the Board's convenience, sections of the Examiner's Answer that are being addressed are provided in block form followed by Appellant's response. Arguments from the original brief are not repeated here and no new issues have been raised.

A. First Ground of Rejection: Claims 1-4, 6-9, and 11-20 under 35 U.S.C. § 102(b) over Zavracky.

1. Claim 1

> The Appellant argues, on Page 6 of the Appeal Brief that Zavracky does not meet the limitation of **Claim 1,** "the hysteresis curve having a smaller width is located fully within the width of the hysteresis curve having larger width" and that Zavracky does not disclose changing the width of the hysteresis curves, rather, silent regarding the opening voltage of the shunt.
>
> Examiner respectfully disagrees. Hysteresis characteristics of a MEMS device means hysteresis width and threshold voltages - opening voltage (or release voltage) and closing voltage (or actuation voltage) of the hysteresis curve. In Column 7, lines 40-44, Zavracky discloses, "each successive micromechanical shunt circuit element 140,141,142,143,144,145,146,147 has a slightly higher closure threshold voltage determined mainly by the dimensions of the cantilever beam contained therein, " and in Column 7, line 65 - Column 8, line 1, discloses, "This variation in length of the cantilever beam provides one of the several ways to vary the threshold voltage of the shunt because longer cantilever beams require lower threshold voltages for closure, all other characteristics being equal." In Figure 21, Zavracky discloses a plurality of MEMS elements, each having cantilever beam 105 of different length. Zavracky's MEMS devices have different hysteresis characteristics as the devices have different cantilever beam dimensions.

The term "hysteresis characteristics" is only used in the Examiner's Answer and does not appear in claim 1. Claim 1 requires more than simply different hysteresis characteristics. In particular, claim 1 requires that the first and second MEMS elements have (1) different opening voltages, (2) different closing voltages and (3) a particular relationship between hysteresis curves, namely, that the hysteresis curve having a smaller width is located fully within the width of the hysteresis curve having the larger width.

In the quoted paragraphs, as well as the remainder of the document, Zavracky only teaches that MEMS devices have different closing voltages. Zavracky is silent regarding the opening voltages and the relationship between the hysteresis curves.

> Examiner agrees that Zavracky is silent regarding the opening voltage. When the length of the cantilever beam is varied, it is inherent that both the threshold voltages, opening voltage and closing voltage, and the width of the hysteresis curve are

> varied. When the cantilever beam dimensions are varied, area is varied, its capacitance is varied corresponding to the change in area, and the amount of charge trapping is varied, and therefore, the width of the hysteresis loop and both threshold voltages are varied. In another words, when the cantilever beam length is varied, the voltage required to bring the cantilever beam 105 to the force plate 102 increases, once it is closed it would take the same amount of voltage to bring it back to fully open or released state by releasing all trapped charges. Zavracky discloses increasing the closure threshold voltages by decreasing the length of the cantilever beam, since each successive MEMS element 140-147 has slightly higher closure threshold voltage and width, each successive hysteresis loop would fully enclose the previous ones.

Appellant respectfully submits that the conclusions drawn in this paragraph are without support and are internally inconsistent. Examiner concludes that a change in the closing voltage necessarily leads to a change in both the opening voltage and the width of the hysteresis curve. This is not true. A change in the closing voltage necessarily leads to a change in the opening voltage and/or the width of the hysteresis curve, but not necessarily both. For example, if the opening voltage varies by the same amount as the closing voltage than the width of the hysteresis curve would not change.

In fact, Examiner seems to argue that opening voltage varies by the same amount as the closing voltage ("once it is closed it would take the same amount of voltage to bring it back to fully open"). If this statement is true, then the width of the hysteresis curve would not change. By definition, the hysteresis width is the difference between the opening voltage and the closing voltage. *See e.g.*, Figure 3; Examiner's Answer, page 19, line 7. If these two voltages must change by the same amount, the difference between the two voltages must not change at all.

More importantly, if the opening and closing voltages change by the same amount, or even in the same direction, the hysteresis curve having a smaller width will not be located fully within the width of the hysteresis curve having the larger width. Instead, the two curves would overlap. This is the situation illustrated in the example provided on page 8 of the Appeal Brief.

> The Appellant argues, on Page 7 of the Appeal Brief that Zavracky does not teach or suggest that opening voltage increases while the closing voltage decreases.
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> In response, Examiner notes that claims does not recite that the opening voltage increases while the closing voltage decreases; Claim only recites that the opening voltage and closing voltage of the first MEMS element being different from the opening voltage and closing voltage of the second MEMS element, with characteristics hysteresis curves differing from the first element to the second, and Zavracky discloses the limitation as discussed above.

In order to anticipate claim 1, Zavracky must show that the hysteresis curve having a smaller width is located fully within the width of the hysteresis curve having the larger width. If the closing voltage varies from one MEMS device to the other, the only way that the hysteresis curve having a smaller width can be located fully within the width of the hysteresis curve having the larger width is for the opening voltage of the other device to vary in the opposite direction. If the opening voltage stays the same or varies in the same direction as the closing voltage, the required relationship between the hysteresis curves will not be met.

> The Appellant argues in an illustrative example, on Pages 7-8 of the Remarks that upon an increase in cantilever beam length, if the opening voltage decreases by about the same as the decrease in threshold voltages for closure, the hysteresis width remains unchanged, and that in such case, an increase in threshold voltage for closure arising from a decrease in cantilever beam length will not result in a wider hysteresis width.
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> In response, Examiner notes that there is no support for this example in Zavracky as Zavracky does not disclose or teach that the hysteresis width kept unchanged or decreasing the opening voltage when the closing voltage is decreased.

On pages 7 and 8 of the brief, Appellant illustrates the situation that Examiner asserts must happen. *See* discussion above. In other words, the illustrations show that the direction of change of the opening voltage will follow the direction of change of the closing voltage. This discussion demonstrates that if Zavracky operates as Examiner asserts it does, the claim limitations will not be met.

> Examiner further notes that Claim 1 only recites that first and second MEMS elements are **designed** such that the hysteresis curve having a smaller width is located fully within the width of he hysteresis curve of the larger width, no specifics of the design is recited or shown in Figures (Figure 10 shows the structure of one MEMS capacitor, not a second or third to indicate how the MEMS capacitors design is different, in length, thickness, width or (insulating) layer, to have the design as recited in the claim).

Appellant is unsure of what is meant by this new point. The meaning of the claim language has never been in dispute. Claim 1 requires that the first and second MEMS elements where the hysteresis curve having a smaller width is located fully within the width of the hysteresis curve having the larger width. All of the arguments in the briefing by Examiner and Appellant are consistent with this claim interpretation. The claim does not require any specific design or any specific physical characteristics such as length, thickness, width or layers.

Claim 11

Claim 11 is directed to the relationship between the hysteresis curve of the first MEMS device and the hysteresis curve of the second MEMS device. In particular, the characteristic hysteresis curves of the first and second MEMS elements are centered around a common centerline in the operational diagram. The sections of the Zavracky reference cited by Examiner have nothing to do with the hysteresis curves and are therefore not relevant.

As discussed above, the Examiner's premise that opening voltage varies by the same amount as the closing voltage leads to the conclusion that claim 11 cannot be anticipated. If the opening and closing voltages vary in the same direction for one device compared to the other, then the center line must also move in that direction. Since the centerline is computed as the midpoint between the opening voltage and the closing voltage, if both go up (or down) then the midpoint

between them will go up (or down). In other words, Examiner's technical analysis leads to the conclusion that claim 11 is not anticipated.

Claims 2-9 and 12-20

Appellant has nothing to add beyond what was stated in the Appeal Brief.

<u>B. Second Ground of Rejection: 1-4, 6-9, and 12-20 under 35 U.S.C. § 103(a) over Miles '532 in view of Sugahara.</u>

1. Claim 1

> The Appellant argues on Page 14 of the Appeal Brief that regarding Claim 1, Miles '532 does not use a single control voltage to access array.
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> In response, Examiner notes Miles '532 teaches a control voltage, Vbias applied to the MEMS elements (IMOD device 10 implemented as MEMS elements, see Paragraph 17, 19) in the array. Miles '532 in Paragraph 28, teaches that hysteresis curve 50 of Figure 5 has a hysteresis width of 2.8 volts (Vclose or Vactuation of 7.8 volts and Vopen or Vrelease of 5.0 volts), and that it is possible to choose a value of Vbias between 5 volts and 7.8 volts to keep the devices in driven state. So the IMOD device 10 of Figure 5 uses a control voltage, Vbias as all the IMODS of the device have the opening voltage and closing voltage between 5.0 volts and 7.8 volts.

Miles '532 goal is to have a single bias voltage that can activate each of the devices that are desired to be activated. This fact is clearly shown in Paragraph 28, which is repeatedly cited in the Examiner's Answer. In particular, Miles '532 teaches that "it is possible to choose a value for the V_{bias} between 5 volts and 7.8 volts which will effectively perform the function of keeping the reflective layer 14 of each respective IMOD device 10 within the reflective display in its driven condition." In other words, a single bias voltage is used to keep those devices that are desired to be in the driven state. Clearly, the devices that are not being driven would not receive this bias voltage.

This teaching is very different than the invention of claim 1. Claim 1 recites that "the input is adapted for applying a single control voltage that is to be applied to all the MEMS elements whereby the various states of the array are to be obtained by varying the single control voltage." In other words, the single control voltage can be used to put some of the devices in the first state and other devices in the second state. This is exactly what Miles '532 is trying to avoid.

> It is true that primary reference, Miles '532 does not specifically disclose that the control voltage applied to all the MEMS is a single control voltage, and the secondary reference, Sugahara is relied upon for the teaching a single control voltage applied to all MEMS elements in an array. In Figures 9, 11, Sugahara discloses an electronic device comprising an array of MEMS elements 230a where a single control voltage is applied to all the MEMS elements (see a single voltage V1 is applied to top array, V2 to the next array).

Miles '532 does not disclose that the control voltage applied to all the MEMS is a single control voltage because it cannot be. Miles '532 teaches a plurality of IMOD devices that are fabricated in a large array so as to form pixels within a reflective display. Par. [0020]. Clearly, individual pixels in the array are either reflective or not depending on the desired image for any given frame. The purpose of the Miles '532 invention is to be able to utilize the same voltage to activate individual pixels. This voltage, however, cannot be applied to pixels that are not to be activated. This fact is clearly stated by Miles '532 which states that it is possible to choose a bias voltage value "which will effectively perform the function of keeping the reflective layer 14 of each respective IMOD device 10 within the reflective display ***in its driven condition***." Par. [0028]. The voltage cannot be used to keep any IMOD device 10 not in the driven condition.

Claims 2-9 and 12-20

Appellant has nothing to add beyond what was stated in the Appeal Brief.

Conclusion

Appellant has addressed issues raised in the Examiner's answer. For the reasons provided in the Appeal Brief and herein, Appellant respectfully requests that that the rejections be reversed so that that case can be passed to issuance.

Respectfully submitted,

December 30, 2009
Date

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